



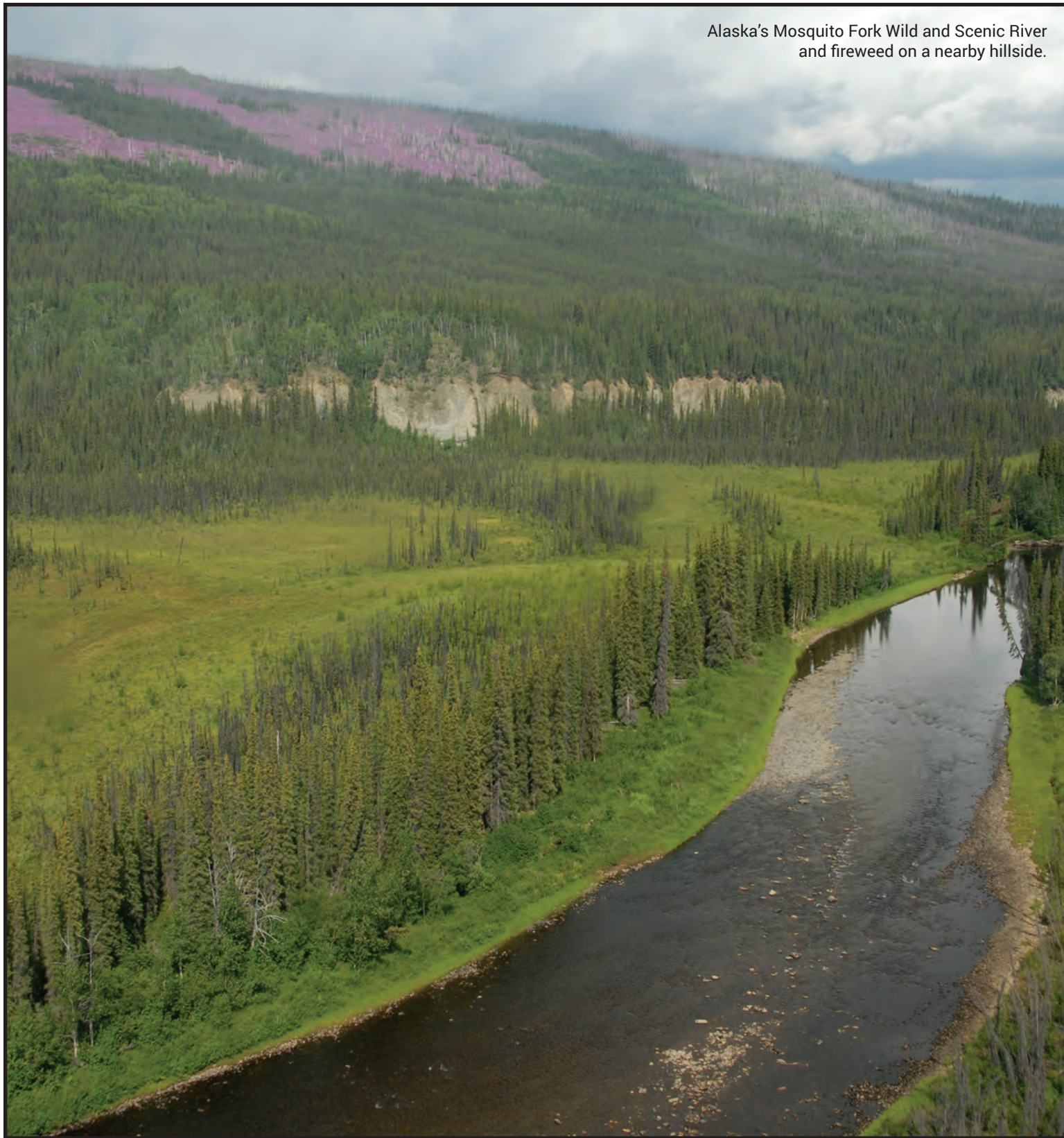
Bureau of Land Management

Soil, Water, and Air Program Highlights

Fiscal Year 2015



Alaska's Mosquito Fork Wild and Scenic River
and fireweed on a nearby hillside.



Production services were provided by the BLM National Operations Center's
Information and Publishing Services Section in Denver, Colorado.

BLM/WO/GI-17/007+7000

Table of Contents

Introduction	1
Soil Highlights	3
BLM and USGS Study Geologic Processes and Sediment Deposition on River Islands – Eastern States	3
Cooperative Efforts Increase Grass and Forb Cover, Control Cheatgrass, and Reduce Erosion – New Mexico	3
Land Management Agencies Implement MOU and Make Notable Progress – Nevada	4
BLM Colorado Continues Badger Wash Study – Colorado	4
Project Reduces Airborne Particulate Matter (PM ₁₀) – Arizona	4
Water Highlights	5
BLM and State of Oregon Coordinate on Water Rights Data Entry – Oregon/Washington	5
Partnership with Trout Unlimited Improves Conditions for Trout in Goodenough Creek – Idaho	5
BLM Nevada State Office Hosts Interagency Drought Training and Tour – Nevada	6
Project at Headwaters Enhances Crowley Creek – Nevada	7
Southern Nevada Continues Restoration of Degraded Springs for Endemic Springsnails – Nevada	8
White River Field Office Implements Upgrades to Monitoring Equipment – Colorado	9
Grand Junction Field Office Achieves Instream Flow Protection for the Lower Dolores River – Colorado	9
River/Lake Gauge Program Continues in the National Petroleum Reserve – Alaska	10
Field Office Monitors Water Quality in Disturbed Streams – Alaska	11
River Gauge Installation Helps Complete Instream Flow Water Rights – Alaska	11
BLM and NRCS Conduct Snow Surveys – Alaska	11
BLM Continues Cooperative Crooked Creek Watershed Assessment – Alaska	12
BLM Performs Water Quality Monitoring in the Fortymile Wild and Scenic River Corridor – Alaska	13
BLM Partners with USGS for Instream Flow Study of Mosquito Fork Wild and Scenic River – Alaska	13
BLM Alaska Pursues Water Rights on Four Rivers in ACEC – Alaska	14
Adjudication Process Begins for Gulkana Water Rights Application – Alaska	14
Partnership Protects Aquifers and Restores Critical Habitat on Wild and Scenic River – California	15
Field Office Partners with Watershed Council – Colorado	16
Ongoing Efforts with Bureau of Reclamation Monitor Blanca Wetlands ACEC – Colorado	16
Kremmling Field Office Participates in a Variety of Projects to Support Colorado River Health – Colorado	16
BLM Colorado Participates in “Take It Outside” Program – Colorado	17
Uncompahgre Field Office Improves Wet Meadow Habitat – Colorado	17
Little Snake Field Office Repurposes Abandoned Artesian Well in Scandinavian Gulch – Colorado	17
Partnership Improves Sagebrush Habitat for Numerous Wildlife Species – Wyoming	18
Cooperative Efforts Help Wyoming State Office Understand and Address Erosion in Riparian Systems – Wyoming	18
Team Training and Ongoing Surveys Document Proper Functioning Condition – Wyoming	19
BLM Performs Conifer Control for Riparian Enhancement – Wyoming	19
BLM Monitors Streams and Rivers across Wyoming – Wyoming	19
Miles City Field Office Performs Restoration after Dam Removal – Montana	20
Dillon Field Office Assesses Watersheds and Restores Trout Habitat – Colorado	21
Inventory Helps to Construct a Database of Lentic Resources and Conditions – Montana/Dakotas	21
MOU Tackles Nonpoint Source Pollution to Improve Water Quality – Montana/Dakotas	22
Air Highlights	23
Project Points Way to Better Air Resource Modeling – Montana/Dakotas	23
BLM and Partners Host Forum about the San Juan Basin Methane Hotspot – Four Corners Region	23
NOC Provides Technical and Air Quality Modeling Support for Numerous NEPA Projects – National Operations Center	23
BLM Continues Climate Monitoring Program at the National Petroleum Reserve – Alaska	24
Portable Equipment Monitors Air Quality at Three Locations – Colorado	25
BLM Supports Global Terrestrial Network for Permafrost in NPR-A – Alaska	25
BLM Supports National Wind Erosion Research Network – Colorado	26
Partnership Entails Sampling Precipitation Chemistry and Quantity – Colorado	26
BLM Completes 3-Year Air Quality Study with the University of Wyoming – Wyoming	27



A project site in La Manga Canyon in New Mexico where efforts decreased erosion and increased native grasses and forbs.



The Bureau of Land Management (BLM) is responsible for more than 245 million acres of public land—about 10 percent of the nation's surface land area. This land is primarily located in 12 Western States, including Alaska. The BLM's multiple-use mission is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. The BLM accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production and by conserving natural, historical, cultural, and other resources on public lands.

Soil, water, and air resources are the most foundational and basic of natural resources. Soil, water, and air processes determine, to a large extent, the structure and function of ecosystems.

Soil provides the foundation for vegetation and biotic communities; sustains resilient, productive grasslands, shrublands, forests, and other areas; safeguards water and air quality; and supports many other resource uses on public lands managed by the BLM.

Water of sufficient quality and quantity is integral to the successful management of public lands. The quality of water generated on public lands is just as important as the quantity because clean water is a necessary resource both for uses by humankind and for ecosystem sustainability. Clean and adequate supplies of water are necessary to promote resilient watersheds, maintain drinking water sources, allow safe recreational use of surface water, and maintain healthy plant communities and wildlife habitats.

Air resources are managed to ensure that the uses the BLM initiates or authorizes on public lands are consistent with the federal, state, local, and tribal regulatory framework under the Clean Air Act. The BLM uses the National Environmental Policy Act process to analyze the potentially significant environmental impacts of its proposed actions on air resources (and other resources) and to select appropriate measures to mitigate adverse impacts. These steps enable the BLM to continue authorizing diverse land uses on public lands while protecting air resources and preparing for new challenges.

Many BLM management decisions require reliable and readily accessible soil, water, and air resource information. Soil, water, and air resource information, combined with sound science, is essential to ensure sustainable resource management and to meet the BLM's multiple-use mission. Soil, water, and air information is critical for the BLM to effectively adapt to a changing climate and to address issues associated with prolonged droughts, increased wildland fires, and establishment of invasive species.

This document presents some fiscal year (FY) 2015 highlights of the BLM Soil, Water, and Air Program and introduces the types of projects and work the BLM state and field offices and national centers contribute to the management of public lands through the Soil, Water, and Air Program.

DATE 5/23/2015
DIST FFO
OSCE
ALLOT 1000
PASTURE 1000
PLOT NO. 1000

A lop and scatter
baseline transect in
La Manga Canyon.

05/28/2015



BLM and USGS Study Geologic Processes and Sediment Deposition on River Islands – Eastern States

In 2015, the BLM Northeastern States District contracted with the U.S. Geological Survey to conduct soil and bedrock analyses on five islands along the Lower Wisconsin State Riverway and the Black River to better understand geologic processes and fluvial deposition patterns that formed these islands. In order to reconstruct the geologic history of each island, the USGS conducted fieldwork in 2014 and 2015, establishing transects and collecting soil cores to characterize soil profiles and determine the approximate ages of the sedimentary layers. These data will inform land use planning decisions and collaborative restoration efforts within this important riverine corridor.

Cooperative Efforts Increase Grass and Forb Cover, Control Cheatgrass, and Reduce Erosion – New Mexico

The BLM Farmington Field Office accomplished many diverse projects in FY 2015 to improve soil, water, and air quality. The field office coordinated a great deal with local conservation groups to apply projects and accomplish goals throughout the field season. This included participating in agreements with the Youth Conservation Corps, Southwest Conservation Corps' Veterans Fire Corps, and San Juan Soil and Water Conservation District.

The field office treated approximately 35 acres in La Manga Canyon that was covered with extensive pinyon pine and juniper and had virtually no understory vegetation. After cutting down the canopy trees, the area was broadcast seeded with native grasses and forbs. Native grasses have a complex root system that helps reduce erosion and sediment loading in streams. The tree limbs of the cut down canopy trees were then scattered around the site to help protect the seeds from birds and also to moderate surface temperatures, increasing seed germination success. Larger sections of cut wood were placed in gullies and along active water features to control further erosion until understory grass and forb cover increases.

In addition, the field office worked cooperatively with Senator Martin Heinrich's office, state and local agencies, Trout Unlimited, local fishing guides, and oil and gas operators to improve road and well pad surfaces and correct erosion issues associated with oil and gas development. These actions will ultimately reduce sedimentation into the Simon Canyon watershed.

Also, the field office removed an abandoned awning from the Valdez River Tract Area of Critical Environmental Concern. This area will be reseeded and planted with native poles. The amount of older cottonwoods have decreased in the area due to heavy beaver activity. As a result, the field office is using beaver-proof fencing to protect trees.

Lastly, the field office aerially treated 4,100 acres of decadent sagebrush habitat and 520 acres of cheatgrass-dominated land to promote perennial grass development, improve range conditions, and decrease soil erosion.



An eroding and below grade road prior to making treatments to reduce sedimentation in the Simon Canyon watershed.



A road after making treatments to reduce sedimentation in the Simon Canyon watershed.

Class participants learn about soil properties and ecological sites.



Land Management Agencies Implement MOU and Make Notable Progress – Nevada

As part of a memorandum of understanding signed in 2014 by the Natural Resources Conservation Service (NRCS), U.S. Forest Service, and BLM, the BLM Nevada State Office actively worked with the NRCS and the University of Nevada-Reno to develop disturbance response groups, state and transition models, and ecological site descriptions (ESDs) across Nevada.

ESDs are used in monitoring, evaluating, and managing the nation's rangelands and forestlands. ESDs are reports that provide detailed information regarding an ecological site, including information on the site characteristics (soils, climate, and water features), plant communities (plant species, vegetation states, and ecological dynamics), and site interpretations (management alternatives). ESDs provide land managers the information needed for evaluating a landscape as to suitability for various uses, capability to respond to different management activities or disturbance processes, and ability to sustain long-term productivity.

As of 2015, the NRCS and University of Nevada-Reno had completed disturbance response groups and state and transition models and developed draft and provisional ESDs for three major land resource areas within Nevada. These areas cover nearly 34 million acres, including more than 11 million acres designated as priority and general sage-grouse habitat on BLM-managed public lands. BLM Nevada and California State Offices also coordinated efforts on development of ESDs for major land resource areas that cross state boundaries. Future efforts in Nevada include completing ESDs for all remaining major land resource areas, finalizing all ESDs, and developing ESDs specific to riparian areas.

Project Reduces Airborne Particulate Matter (PM₁₀) – Arizona

The BLM Hassayampa Field Office treated five parking areas with black gravel and surface compaction in an effort to reduce airborne particles less than 10 micrometers in diameter (PM₁₀). Before treatment, the consistency of the parking areas resembled talcum powder. The black gravel treatment resulted in reduced PM₁₀ loading and can be retreated and recompact in the future.



BLM Colorado Continues Badger Wash Study – Colorado

In 2014, the U.S. Geological Survey, in coordination with the BLM, installed a network of flumes, silt fences, precipitation gauges, and dust collectors above reservoirs in subwatersheds in Badger Wash, near Mack, Colorado, to measure hillslope erosion rates. These rates will be used to customize key parameters in the Rangeland Hydrology Erosion Model for more accurate quantification of erosion and salt contributions to the Colorado River from public lands with Mancos shale formations. Currently, the BLM Grand Junction Field Office uses the Rangeland Hydrology Erosion Model results to help develop disturbance thresholds in Mancos shale landscapes as part of the BLM's comprehensive travel management planning effort. Monitoring efforts continued in FY 2015. The BLM will continue to use these data for more model development and also for assessing a broader category of effects, rather than travel management alone.



Silt fences constructed in western Colorado and hillslope erosion and climate and flow monitoring equipment.



Dust and wind erosion monitoring equipment in Badger Wash.

BLM and State of Oregon Coordinate on Water Rights Data Entry – Oregon/Washington

The BLM holds approximately 5,000 water rights with the Oregon Water Resources Department (OWRD). In 2014, the OWRD increased the level of effort required to report on annual water usage. The change would have required the BLM to report on each water right for each month—requiring 60,000 data entries per year. Due to this potentially heavy annual workload, the BLM opened a dialog with the OWRD about the possibility of automating some of the process by using spreadsheets prepopulated with the previous year's reporting numbers.

Working with the BLM Oregon State Office software development team, the OWRD developed a process that works for both agencies. This reporting process also assists many others in filing their annual claims, including the U.S. Forest Service and cattle ranchers and irrigators in the central valley.

To increase the use and utility of the process, the OWRD developed a short course on water rights for the state and included real-world examples of how to file, what to file, and where to find all key data within a water right. The full-day training course was held at the annual BLM soil, water, and air meetings in both eastern and western Oregon. With support and perseverance, all BLM Oregon districts were brought up to speed for annual water rights reporting in 2015, and the reporting process was much easier for all thanks to the work with the OWRD.

Report ID	Name	Description
2701	POWERLINE RES (10-44-01)	POWERLINE RES (10-44-01) UNPAVED STREAM 100-340-21-04-01
2702	DEEP SPRING (10-44-01)	DEEP SPRING (10-44-01) UNPAVED STREAM 100-340-21-04-01
2703	MUD HOLE RES (10-44-01)	MUD HOLE RES (10-44-01) UNPAVED STREAM 100-340-21-04-01
2704	SHORE ON RES (10-44-01)	SHORE ON RES (10-44-01) UNPAVED STREAM 100-340-21-04-01

Example of a water rights report required by Oregon. A new reporting method developed by the Oregon Water Resources Department, at the request of the BLM, has saved countless hours, if not weeks, of data entry. The Burns District has approximately 1,500 rights to enter each year (about 18,000 individual entries), which are now nearly automatic using the new process.

Partnership with Trout Unlimited Improves Conditions for Trout in Goodenough Creek – Idaho

The BLM Idaho soil, water, air, and fisheries programs partnered with a local Trout Unlimited chapter to improve water quality, create necessary overwintering habitat, and reconnect critical habitat for an isolated population of genetically distinct Yellowstone cutthroat trout in Goodenough Creek, located south of Pocatello, Idaho. The Yellowstone cutthroat trout is one of several native trout species found in the Rocky Mountain region. Its habitat loss is closely related to declining water quality, and its genetic identity is being diluted due to hybridization. The BLM and Trout Unlimited identified water quality and fish passage issues related to poorly constructed road crossings, streambank erosion, and concentrated recreational use of Goodenough Creek.

This multiyear partnership included constructing instream step pools for erosion control and habitat maintenance, creating additional in-channel habitat, treating streambanks to reduce bank erosion, replacing culverts to improve fish passage, decommissioning certain roads, and moving recreational uses out of riparian areas. The stream channel within the new culverts was designed to mimic natural channel characteristics, such as size, slope, and structure, and should be more dynamically stable in an ever-changing stream environment, passing and storing sediment similar to a natural channel. The main goals of removing the manmade barriers and restoring instream habitat are to improve water quality, expand Yellowstone cutthroat trout habitat, and increase the population resilience of the species.



A group discusses site conditions and concerns during the drought effects tour.

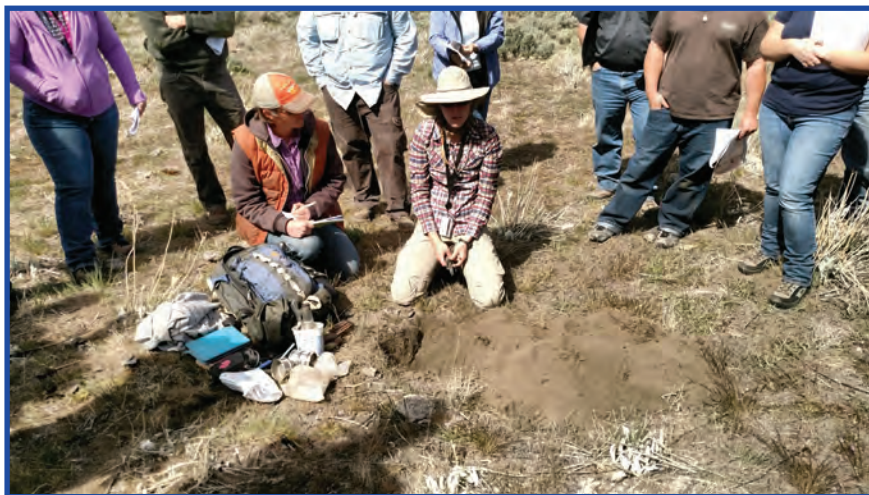


BLM Nevada State Office Hosts Interagency Drought Training and Tour – Nevada

Nevada has been in a state of drought since 2011. Thus, drought conditions have become an important factor when analyzing effects from proposed authorized uses of public lands. To help district and field offices, the BLM Nevada State Office, in coordination with the BLM National Riparian Service Team, held a drought assessment training and landscape condition tour in April 2015.

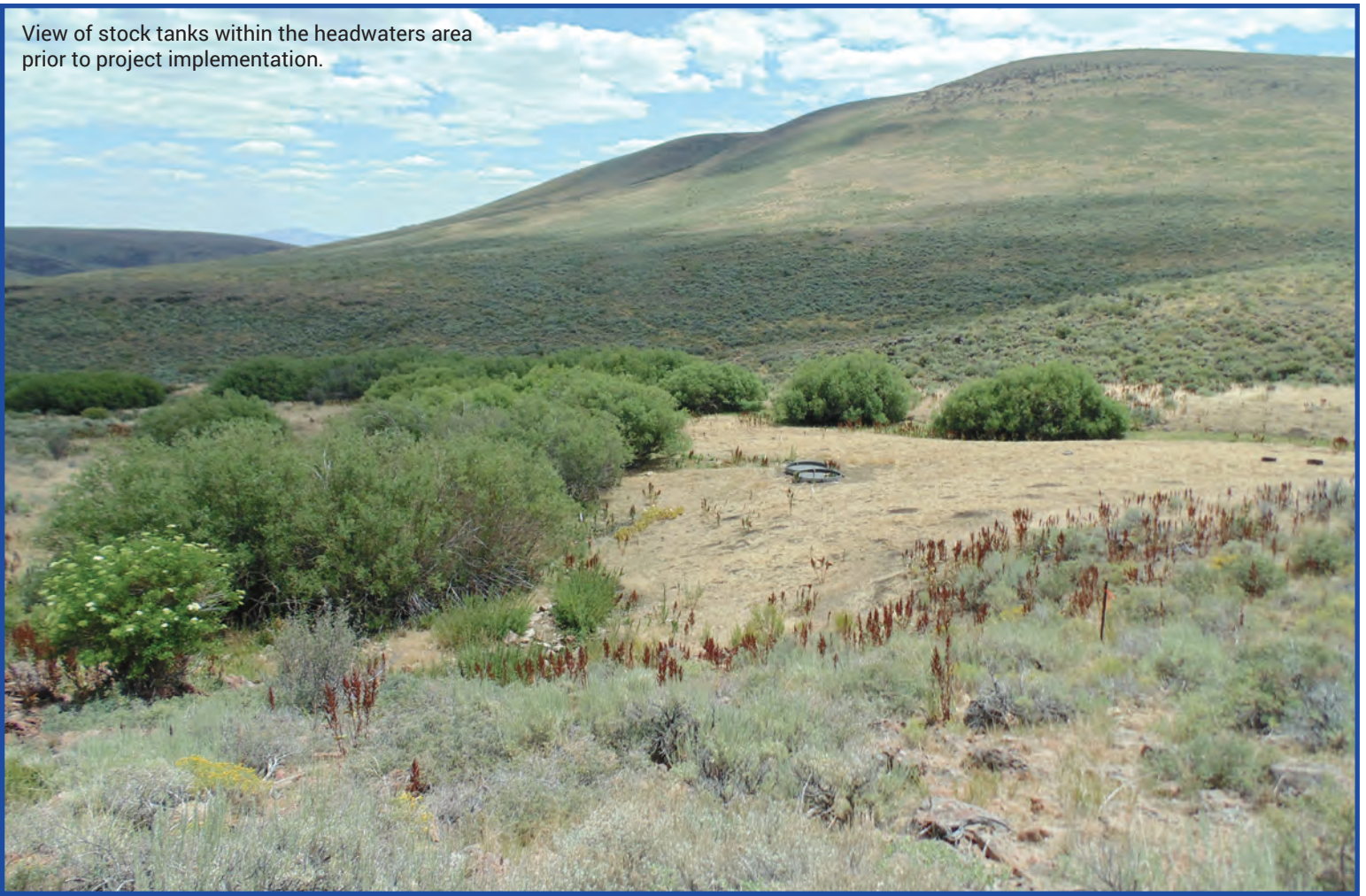
The training session consisted of a multiprogram approach to address comments and questions regarding land management during times of drought. Attendees included field staff and managers from across Nevada, and the training provided a forum for participants to come together, share information about their field offices, and build a common understanding during the drought effects tour. Technical sessions addressed multiple issues that have arisen over the last several years regarding analysis of effects and managing public lands under drought conditions. Presentations included use of the U.S. Drought Monitor and the Vegetation Drought Response Index (VegDRI), assessing soil moisture availability, use of infrared imagery to assess riparian areas, calculating water availability, plant physiology, choosing monitoring sites and methodologies, and measuring forage production. Experts from the Nevada Department of Wildlife, U.S. Fish and Wildlife Service, Farm Service Agency, and Natural Resources Conservation Service presented information on resource management efforts and how the BLM can assist with those efforts.

On the drought effects tour, participants visited sites on five districts and discussed drought effects and issues for managing public lands under drought conditions. The intent was to identify lessons learned during the past 3 years of on-the-ground land management and to formulate a strategy for moving forward as drought conditions continue. The training and tour elements offered an opportunity to openly discuss the current situation and explore more efficient and effective ways to use the available suite of management tools. One of the most discussed topics throughout both the training and tour was acknowledgment of the importance of understanding soils science, having knowledge of soil-vegetation relationships, and effectively using ecological site descriptions.



BLM hydrologists Michelle Stropky and Niki Cutler give the group a lesson on soil identification and the importance of understanding soils in land management.

View of stock tanks within the headwaters area prior to project implementation.



Project at Headwaters Enhances Crowley Creek – Nevada

The BLM Winnemucca District Office partnered with the Nevada Department of Wildlife, U.S. Fish and Wildlife Service, and an associated permittee to design and construct a “wildlife friendly” exclosure and a new spring headbox and distribution system in the headwaters of Crowley Creek in Nevada’s Montana Mountains. Monitoring data had indicated adverse impacts to Crowley Creek and its water source at the springs due to grazing.

The watershed is important because Crowley Creek is occupied by the federally threatened Lahontan cutthroat trout. The Lahontan cutthroat trout population in Crowley Creek is genetically unique and highly desirable as a source to stock other streams inhabited with this species. In addition to being a unique fishery, the area is also one of the most densely populated areas for Greater Sage-Grouse and is important brood-rearing habitat for the bird. Populations of pygmy rabbits also occupy this watershed.

This project addressed livestock impacts to the headwaters, while maintaining water for the Crowley Creek Lahontan cutthroat trout and the permittee’s livestock. This project displays a prime example of an interdisciplinary program approach (fisheries, wildlife, soil and water, and range), interagency cooperation (BLM, Nevada Department of Wildlife, and USFWS), and public stakeholder involvement to assure agreed-upon goals and science-based outcomes. The next phase will involve control of weeds and revegetation with appropriate native grasses and forbs to restore soil and hydrologic functions. This will improve habitat conditions for many species. The BLM will continue monitoring to ensure a successful outcome.



View of the fence exclosure and relocated stock tank outside the exclosure.



View of the area, which shows the need for weed control and restoration of native grasses and forbs.

Southern Nevada Continues Restoration of Degraded Springs for Endemic Springsnails – Nevada

In FY 2015, renewable resources staff in the Southern Nevada District Office continued efforts to restore degraded springs for two species of endemic springsnails—the Spring Mountains springsnail (*Pyrgulopsis deaconi*) and the Southwest Nevada springsnail (*Pyrgulopsis turbatrix*). Both species have been petitioned for federal listing as threatened or endangered. Their remaining aquatic habitat was limited to a few square feet in some springs. Springsnails are tiny freshwater mollusks that help shape water chemistry, nutrient cycling, and rates of productivity and breakdown, which in turn helps countless other species.

When restoration work began, as early as 2000, the Spring Mountains springsnail had been restricted to one spring in Red Rock Canyon National Conservation Area (Red Spring) and one spring in the Las Vegas Field Office (Kiup Spring), which was severely overgrown with invasive grasses. Restoration work in 2011 on Willow Spring in the Red Rock Canyon NCA culminated with the successful reintroduction of the Spring Mountains springsnail.

In 2012, the Southern Nevada District Office began a districtwide effort to restore degraded springs for the springsnails. In 2013, restoration actions at Kiup Spring included removing monoculture grasses and restoring native forbs and trees. Spring Mountains springsnail populations quickly took advantage of the new habitat. Monitoring data from U.S. Geological Survey stream gauges help in evaluating the success of restoration efforts.

In support of the Southeast Nevada springsnail, the BLM acquired a 37-acre property and water rights for Grapevine Spring in January 2012. The spring is one of 10 springs that supports populations of the Southeast Nevada springsnail. The U.S. Geological Survey had measured spring discharge since September 2013.

In March 2015, 600 feet of jack rail fencing was installed at Grapevine Spring to improve water quality and reduce vegetation trampling associated with overuse by wild horse and burro populations. Also, an old mining pond was breached to restore streamflow to a historic channel, providing access to water for wild horses, burros, and other wildlife. Monitoring of vegetation response will be conducted for a year, and the effects on the springsnail population will be evaluated before installing additional fencing downstream.



Springsnails (black dots) at Grapevine Spring.



Dense vegetation completely obscuring water (and springsnail habitat) at Kiup Spring in March 2013.



Removing dense grasses and sedges at Kiup Spring in June 2013.



Grapevine Spring in July and September 2013 (before restoration).



Grapevine Spring in March and April 2015 (after restoration).



Native vegetation (mostly) returning to Kiup Spring. Weed management is ongoing.

White River Field Office Implements Upgrades to Monitoring Equipment – Colorado

In FY 2015, the White River Field Office improved and updated several types of precipitation, water quality, and air quality monitoring equipment. To start, the field office updated a precipitation monitoring network, which includes 12 sites, to the National Weather Service standard by retrofitting all of the gauges with new measuring (tipping) mechanisms. This upgrade eliminates the need to post-correct winter precipitation data and improves measurement accuracy.



An upgraded rain gauge with a precipitation adaptor and waste antifreeze reservoir at Wolf Creek.

Next, the field office made upgrades to a data logger for precipitation and stream monitoring sites. This significantly improves network reliability and measurement precision and reduces post-collection data processing by 75 percent. Satellite communication capabilities were added to five of the upgraded stream monitoring network sites, eliminating the need for site visits and allowing timely field responses to repair damaged/faulty monitoring equipment. This capability reduces gaps in data collection.

The field office procured a YSI 9500 photometer and a peristaltic pump, which expands stream and spring water quality sampling and monitoring capabilities. Additional field sampling protocols for the new photometer were implemented to monitor alkalinity, chloride, magnesium, sulfate, calcium, iron, and phosphate at five stream monitoring sites and all surveyed springs. The peristaltic pump permits filtering of samples prior to sending to a lab, which improves overall accuracy and reduces lab costs.

Lastly, with assistance from the Agricultural Research Service, the field office added digital cameras to the Rangely and Meeker air quality stations to monitor visibility. Also, a new air quality (visibility and meteorological) monitoring site was installed on Magnolia Ridge in the Piceance Basin, and a real-time webpage displaying data from the Rangely, Meeker, and Piceance Basin monitoring sites was created.



A White River Field Office employee uses a peristaltic pump to collect water samples from a spring above Rangely, located in an abandoned oil well.



A new visibility and meteorological monitoring site located on Magnolia Ridge in the Piceance Basin.

Grand Junction Field Office Achieves Instream Flow Protection for the Lower Dolores River – Colorado

The Grand Junction Field Office, working in close partnership with state agencies, achieved significant instream flow protection for sensitive fish species on the lower Dolores River. The BLM collected data and conducted habitat modeling with Colorado Parks and Wildlife personnel to identify flow rate values appropriate for sustaining genetically pure populations of flannelmouth sucker, bluehead sucker, and roundtail chub. A joint agency instream flow protection plan was recommended to the Colorado Water Conservation Board, the only entity in Colorado with authority to appropriate instream flow water rights. The board voted to proceed with the appropriation to assure flow rates ranging from 900 cubic feet per second to 100 cubic feet per second, depending on the time of year. The BLM and U.S. Geological Survey installed a stream gauge on the Dolores River to monitor performance of the instream flow appropriation.



The Dolores River near the confluence with West Creek near Gateway, Colorado.



Ikpikpuk River gauge.

River/Lake Gauge Program Continues in the National Petroleum Reserve – Alaska

In the National Petroleum Reserve in Alaska, the BLM operates numerous river gauges and a lake-level gauge to monitor annual peak stage and flow rate. The BLM also assists in operating two river gauges with the U.S. Geological Survey. All of the gauges are distributed across three physiographic regions and situated close to oil development areas or along possible pipeline routes that cross major rivers.

Peak stage and flow rate help in determining the 100-year flood elevation and floodplain for bridge and culvert design, effects from in-channel snow and ice during breakup, and timing of adjacent lake recharge. Continual data from these

gauges is needed to support estimates of peak, mean, and flow-duration statistics used to design stream crossings and streamside structures and in assessments of fish habitat and stream passability.

The gauges contain 7 to 14 years of data, depending on the gauge. Year-to-year data can be helpful in studying changes in climate, which may result in changes to the timing and magnitude of breakup flows. In addition, real-time gauge data are used to inform river users, such as people floating the river, researchers, and subsistence users, about floods or low water events.



Ublutuoch River in the spring (left) and summer (right).

Field Office Monitors Water Quality in Disturbed Streams – Alaska

Soil, water, and air staff in the Central Yukon Field Office monitored water quality in a number of disturbed streams in the summer of FY 2015, focusing on areas with active placer mines. In these areas, water quality meters were placed above and below the mines, providing data on the effect of placer mines on multiple water quality parameters, with an emphasis on turbidity. Turbidity data can be useful in assessing how much sediment erosion and transport is occurring as a result of mining activities, in addition to the sediment fluxes that naturally occur. The data is used by soil, water, air, fisheries, riparian, and mining compliance staff.



Water quality meter in a stream on public lands managed by the Central Yukon Field Office.



Prospect Creek in Alaska where a river gauge was installed to complete an instream flow water rights application.

River Gauge Installation Helps Complete Instream Flow Water Rights – Alaska

A river gauge was installed on Prospect Creek in Alaska as part of an ongoing project to complete an instream flow water rights application. Data from the gauge, combined with stream discharge measurements, are used to evaluate the hydrology of the river. Prospect Creek has high fisheries values, and portions of the river run through the Jim River Area of Critical Environmental Concern. In addition, multiple mining operations are active on Prospect Creek.

BLM and NRCS Conduct Snow Surveys – Alaska

Partnering with the Natural Resources Conservation Service, the BLM conducts snow surveys at seven sites along the Dalton Highway between the Yukon River and Table Mountain throughout the winter season. Manual survey measurements involve collecting both snow depth and density, in order to calculate a snow water equivalent at each site. Data collected during snow surveys and at automated sites are used to create water supply forecasts, track short- and long-term changes in snow pack, enter into climate models, and plan recreational trips.



A BLM staff member conducts a snow survey in December 2015.

BLM Continues Cooperative Crooked Creek Watershed Assessment – Alaska

The BLM Eastern Interior Field Office and Alaska Department of Environmental Conservation continue to collaborate on a multiyear monitoring project that was initiated in 2014. The project involves documenting flows and water quality for two adjacent placer-mined watersheds in interior Alaska—the Crooked Creek watershed, which is primarily on state land, and the Birch Creek watershed, which includes the Birch Creek National Wild River managed by the BLM. This project is a high priority for the BLM because Crooked Creek is a major tributary to Birch Creek National Wild River, and the Crooked Creek headwaters are adjacent to the eastern boundary of the BLM-managed Steese National Conservation Area.

Much of the 510-square-mile Crooked Creek watershed has been placer-mined, which began in the early 1900s. In 1992, several of the streams within the watershed were listed in an Alaska Department of Environmental Conservation report as water quality-impaired due to turbidity. Turbidity sources in the watershed include both point sources from active placer mines and nonpoint sources, such as runoff from active and abandoned placer mines, streambank erosion, and resuspension of deposited sediment.

Michelle Hale, the Director of the Alaska Department of Environmental Conservation, noted, “The Crooked Creek watershed assessment is a high priority for the division and will hopefully result in actions leading to improved water quality. The data will also complement efforts by BLM in the Birch Creek watershed.”

Water quality assessment of highly disturbed streams in interior Alaska is challenging. This is due, in part, to the remoteness of monitoring sites, but also because of the extreme climate. Ice accumulation during winter often delays deployment of instruments until late May. And flashy streamflow in summer, coupled with high transport of coarse bedload material in unstable placer-mined streams, frequently results in damage or loss of monitoring equipment.



Upstream view of a placer-mined tributary of Crooked Creek showing a stream reach confined by stacked unconsolidated placer tailings on the left and right side of channel. The stream is in disequilibrium with frequent morphological changes as a result.



This view shows aufeis accumulation filling the valley bottom on a small tributary of Birch Creek. Aufeis typically forms by the upwelling of river water behind ice dams or by ground water discharge. Successive ice layers form throughout winter and can lead to aufeis accumulations that are several feet thick. Aufeis typically melts during summer and will often form in the same reach year after year.



This view is upstream on a placer-mined tributary of Birch Creek and shows a BLM hydrologist measuring water quality in a highly active coarse gravel stream channel. High bedload sediment transport rates are common in highly disturbed, high-gradient placer-mined watersheds.

BLM Performs Water Quality Monitoring in the Fortymile Wild and Scenic River Corridor – Alaska

During open water season, typically May through September, the BLM monitors water quality in the Fortymile Wild and Scenic River corridor using automated multiparameter water quality meters at selected sites. Much of the Fortymile Wild and Scenic River system is within the historic Fortymile placer mining district. Turbidity is one of the principal parameters monitored. Potential sources of elevated turbidity in the watershed include both point sources from active placer mines and nonpoint sources, such as runoff from active and abandoned placer mines, as well as natural streambank erosion and resuspension of deposited sediment.

Generally, for streams in this river corridor, increased discharge associated with storm events results in increased turbidity levels, both in watersheds disturbed by placer mining and in natural watersheds with no placer mine disturbance. However, preliminary results show watersheds disturbed by past or present mining usually experience more days of elevated turbidity, frequently of higher magnitude, than undisturbed watersheds. Gaining a better understanding of long-term water quality variability, including parameters of pH, temperature, conductivity, and turbidity, in the 5,880-square-mile watershed remains a primary focus of this study.



Automated multiparameter water quality meter used in the Fortymile Wild and Scenic River water quality study.



West Fork of the Dennison Fork of the Fortymile Wild and Scenic River downstream from the Taylor Highway Bridge.



Downstream view of the Mosquito Fork Wild and Scenic River near Chicken, Alaska.

BLM Partners with USGS for Instream Flow Study of Mosquito Fork Wild and Scenic River– Alaska

In 2015, the BLM partnered with the U.S. Geological Survey to install and operate an automated stream gauge station near the upstream extent of the “wild” section of the Mosquito Fork of the Fortymile Wild and Scenic River. This begins 1 of 5 years of flow data, which is required to file an instream flow water right application for the upper segment of the Mosquito Fork Wild and Scenic River with the State of Alaska. Streamflow data is also essential for evaluating health and instream functions of the river. The BLM will continue inventory and monitoring of water quantity (instream flow) and quality (turbidity) to better understand effects from suction-dredge activity and support management actions to protect the long-term health and functions of the Mosquito Fork.

BLM Alaska Pursues Water Rights on Four Rivers in ACEC – Alaska

For the second year, the BLM Glennallen and Anchorage Field Offices measured discharge to acquire instream water rights on four rivers within the Carter Spit Area of Critical Environmental Concern. This effort is part of implementation of the Bay Resource Management Plan. The project is planned for a total of 5 years and involves not only discharge measurements but also includes hourly water and air temperature measurements between early summer and late fall field visits.

The BLM has also performed geomorphic channel surveys and collected other physical habitat information at sites along these four rivers. In addition, minnow traps are deployed during field visits in an effort to enhance the BLM's understanding of fish species distribution, specifically salmon species. The BLM reports information about juvenile salmon to the State of Alaska, which then updates the Anadromous Waters Catalog; in Alaska, anadromous streams have special protections under state statutes.



A BLM employee measures discharge in Canyon Creek.

Adjudication Process Begins for Gulkana Water Rights Application – Alaska

In 2015, the BLM Glennallen Field Office began the Gulkana River water rights adjudication process. The Gulkana River is a designated national wild and scenic river. The Alaska Department of Natural Resources is ready to begin adjudication on the three 1996 water rights applications on the Gulkana River's West Fork, Middle Fork, and Main Stem. In support of these applications, the BLM has been working on an open file report to summarize a data collection program that began in 1997. These data may be used to update the original application quantities. To date, this is only the second water rights application to be adjudicated by the BLM in Alaska.



BLM Alaska employees perform winter streamflow measurements on the Gulkana River.



The site of fall streamflow measurements on the Gulkana River.



Amargosa vole.

Partnership Protects Aquifers and Restores Critical Habitat on Wild and Scenic River – California

The BLM Barstow Field Office and California and Nevada State Offices partnered with the California Department of Fish and Wildlife, U.S. Geological Survey, U.S. Fish and Wildlife Service, University of California-Davis, The Nature Conservancy, and Amargosa Conservancy to protect source aquifers and restore critical habitat for endangered species on the Amargosa Wild and Scenic River in the Mojave Desert. This ground water-fed river is located between Death Valley and Nevada and contains 17 miles of perennial surface flow that provides habitat for seven threatened and endangered species.

The Amargosa River is a part of the much larger Death Valley Regional Groundwater Flow System, which also encompasses Devils Hole, Ash Meadows National Wildlife Refuge, Yucca Mountain, and the Nevada National Security Site. Endemic to the Amargosa Wild and Scenic River is the critically endangered Amargosa vole (*Microtus californicus scirpensis*), which occupies spring-fed bulrush marshes along the river. Only 300 Amargosa voles remain in the wild, within a range of less than 20 square kilometers. The California drought has further contracted the suitable habitat for vole, and the BLM is working with the University of California-Davis to develop and implement habitat restoration actions.

Through the partnership, the BLM installed piezometers, conducted seepage runs along the river, gauged river and spring flows, conducted geochemical analysis of springs, improved geologic mapping, and developed geologic cross sections. Agency partners are also working to increase water levels by manipulation of a standpipe that drains a key marsh. Preliminary results are encouraging.



Stephanie Castle, University of California-Davis wetland ecologist, explains data collection and monitoring of bulrush habitat characteristics to a local high school student.



Stephanie Castle, University of California-Davis wetland ecologist, collects soil moisture and vegetation cover data.



California Department of Fish and Wildlife employees install standpipe to increase inundation and soil moisture in critical habitat for the Amargosa vole.

Field Office Partners with Watershed Council – Colorado

The BLM Colorado River Valley Field Office partnered with the Middle Colorado Watershed Council to perform efforts to improve the watershed health along the Colorado River. First, the partners completed a geospatial analysis to identify sources of selenium and other potential contaminants. They also finalized a water quality sampling plan to address data gaps. The BLM hired a seasonal hydrology technician and partially supported an AmeriCorps volunteer to collect water quality samples from June to October 2015 at key locations in the watershed. The partnership plans to continue collecting samples and performing restoration efforts to support source loading reduction goals.



A BLM hydrology technician and an AmeriCorps volunteer scout a location for water quality sampling. Numerous water developments and flood irrigation practices across saline geology/soils are contributing factors to high selenium loads and water quality impairments.

Ongoing Efforts with Bureau of Reclamation Monitor Blanca Wetlands ACEC – Colorado

The BLM San Luis Valley Field Office partnered with the Bureau of Reclamation's water quality laboratory in Alamosa, Colorado, to monitor analyses across the Blanca Wetlands Area of Critical Environmental Concern. The objectives of this study are to document water quality across playa wetland systems to help characterize the site, identify issues for management, and correlate water quality to macroinvertebrate diversity and biomass. This intensive effort has been ongoing for several years and promotes youth engagement and minority hiring practices for filling intern positions to collect the data. The BLM collects samples for 44 water quality parameters at 5 locations on each of 6 ponds twice a year, resulting in more than 2,600 data points per year. This work is valuable in identifying areas where the parameters are at critical levels for impacting either species or their habitat. The data also provide guidance for adaptive management through irrigation to maximize habitat productivity for nationally significant shorebird populations and 13 threatened, endangered, and sensitive species.



An intern collects data in one of the ponds.

Kremmling Field Office Participates in a Variety of Projects to Support Colorado River Health – Colorado

The BLM Kremmling Field Office participated in various projects throughout the fiscal year in support of the Colorado River and its tributaries. First, the field office installed three temperature sensors on the Colorado River to inform anglers of current river conditions, with the intent of reducing fishing activities when water temperatures are high. In addition to notifying anglers, the sensor data were shared with the Upper Colorado River Wild and Scenic Stakeholder Group to help track outstanding remarkable values on the river, including water quality. The field office also assisted Colorado Parks and Wildlife biologists in collecting giant salmonfly (*Pteronarcys californica*), and the BLM National Aquatic Monitoring Center

analyzed macroinvertebrate samples from the river. The field office also monitored flows, temperature, and water quality on six Colorado River tributaries, as part of the Grand County Water Information Network.





Middle school students learn to monitor stream and riparian resources.



BLM Colorado Participates in “Take It Outside” Program – Colorado

The BLM Uncompahgre Field Office participated in the “Take It Outside” program by introducing 600 sixth graders to macroinvertebrates in the Gunnison River. The program helps ensure that young people from all backgrounds have access to outdoor recreational opportunities on public lands while fostering future generations of public land stewards. Before turning the kids loose on the river, BLM staff taught the students about overall watershed health and water quality impacts. After the presentation, the students pulled rocks out of the river to find and identify macroinvertebrates.



Rock structures for Gunnison sage-grouse habitat improvement.

Uncompahgre Field Office Improves Wet Meadow Habitat – Colorado

The BLM Uncompahgre Field Office worked with the Western Colorado Conservation Corps to construct 85 Zeedyk rock structures to improve wet meadow habitat for Gunnison sage-grouse. These structures—which are called media lunas, zuni bowls, and filter dams—slow down water as it moves through the landscape. These structures decrease erosion, which helps in the establishment of new riparian vegetation. The BLM obtained permits for placing rock in the floodplain from the Army Corps of Engineers.



Scandinavian Gulch well near Craig, Colorado, before repair.

Little Snake Field Office Repurposes Abandoned Artesian Well in Scandinavian Gulch – Colorado

In 2015, staff from the BLM Little Snake Field Office repaired a wellhead near the Scandinavian Gulch to improve the range and enhance habitat for wildlife, including the Greater Sage-Grouse. The well is located 7 miles from Scandinavian Gulch, which is a tributary to the Little Snake River near the Colorado/Wyoming border. It was installed in the late 1980s to support a gold mining operation and was abandoned shortly thereafter. The wellhead infrastructure had deteriorated during the decades, by the time the land was transferred to the BLM. The above-ground portion of the casing had become corroded, causing the main shutoff valve to fail. The field office repaired the wellhead so the flow can be controlled. The office also implemented a design that pipes the water through 5 miles of adjacent BLM land to tire tanks that will be allowed to overflow continuously during the growing season. This will enhance wildlife habitat in this semiarid landscape and will also create a water source for livestock in nearby grazing allotments. It should provide water reliably into the future and will be particularly valuable in times of drought.



This tire tank, which was installed in Scandinavian Gulch, serves as both a range improvement and as a habitat enhancement that will provide water to wildlife by overflowing onto the surrounding landscape during the growing season.

Partnership Improves Sagebrush Habitat for Numerous Wildlife Species – Wyoming

The BLM Lander Field Office partnered with the Wyoming Conservation Corps, Devon Energy, and Wyoming Office of State Lands and Investments on a 10-day conservation project within core sage-grouse habitat in the Wind River Basin in Wyoming. An area within the basin was losing soil and organic materials, which threatened the meadow's ability to hold water. By fencing off a riparian area to keep out grazing livestock, staff were able to recontour and reseed the riparian area. Elk, deer, and antelope also depend on this habitat. As part of a second riparian enhancement project on public land, Wyoming Conservation Corps crew members felled beetle-killed trees over an existing livestock trail up Green Mountain. This project will limit overuse of a single trail and reduce erosion.

Members of the Wyoming Conservation Corps fence off a riparian area from livestock to halt the loss of soil and organic materials.



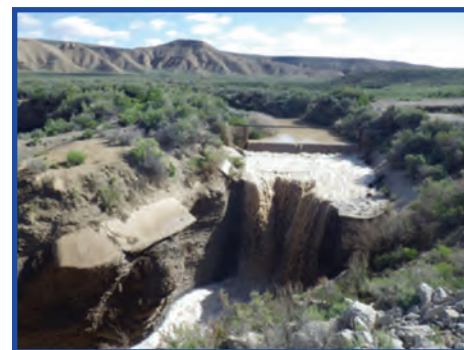
Cooperative Efforts Help Wyoming State Office Understand and Address Erosion in Riparian Systems – Wyoming

The BLM Wyoming State Office worked with the Agricultural Research Service in developing a technique to study headcuts in the upper Sweetwater River subbasin near South Pass in Wyoming using remote sensing techniques. Properly functioning riparian systems slow runoff and store water, thus regulating extreme flows; however, riparian areas across the West are in a degraded condition and many BLM-managed riparian systems are not in proper functioning condition. Headcuts are the leading edge of channel erosion, which results in lost organic material, mineral soil, and water-holding capacity. Aerial image surveys, three-dimensional images from ground-based photogrammetry, and numeric modeling show highly detailed topographic relief within these erosion features and provide baseline position/elevation data for trend monitoring. The Wyoming State Office continues to collaborate with others on this project to further develop this technique.

Also, the BLM Rock Springs Field Office worked with Sweetwater County, Sweetwater County Conservation District, Wyoming Landscape Conservation Initiative, Rock Springs Grazing Association, private landowners, and others to address headcut erosion on the Pirette Ditch, a failing irrigation structure. If left unchanged, the continued channel drop would negatively affect channel function, public transportation, reclamation efforts, and habitat on state, federal, and private lands.



A headcut in 2010 (top) and a 3D model image from 2013 (bottom) illustrate the loss of organic material, mineral soil, and water-holding capacity in this wet meadow.



The Pirette Ditch headcut on Bitter Creek in Sweetwater County, Wyoming. This headcut is more than 50 feet tall.



A proper functioning condition survey underway within the BLM Kemmerer Field Office.



The 2015 "Proper Functioning Condition for Professionals" class on a reach of the upper Bitter Creek above Maggie Springs in Sweetwater County, Wyoming.

Team Training and Ongoing Surveys Document Proper Functioning Condition – Wyoming

BLM Wyoming performed ongoing proper functioning condition surveys throughout the 2015 field season across Wyoming. Many of the surveys repeated work on earlier surveys that were conducted 5 or more years ago. Surveyors noted improvements in land condition at many locations. Also, the National Riparian Service Team held a class titled "Proper Functioning Condition for Professionals" at the BLM Rock Springs Field Office in August 2015. Participants represented a range of ecological disciplines and many offices across BLM Wyoming.



Junipers were cut back 100 feet on both sides of the drainage.

BLM Performs Conifer Control for Riparian Enhancement – Wyoming

The BLM participated in ongoing removal of juniper trees to improve watershed condition in the Bear Spring Creek drainage in Natrona County, Wyoming. Encroachment of juniper into riparian areas changes soil chemistry and channel morphology. A proper functioning condition assessment rated the drainage as "functional at-risk" with a downward trend. The goal of this project is to decrease soil water uptake by removing junipers, which will further allow riparian vegetation to reestablish.



Bolton Creek gauging station (left) and the delta (right) created by sediment from Bolton Creek in the North Platte River.



BLM Monitors Streams and Rivers across Wyoming – Wyoming

BLM Wyoming operates several gauging stations in streams and rivers across Wyoming to monitor streamflow, water quality, and turbidity. The BLM Casper Field Office operates the Bolton Creek gauging station. A large amount of sediment makes its way into the North Platte River from Bolton Creek. The data from the Bolton Creek gauging station is instrumental in efforts to help control erosion in the basin.

Temporary grade control structures on Lone Tree Creek in August 2015.



Miles City Field Office Performs Restoration after Dam Removal – Montana

The Blackfoot Dam was constructed in the 1950s to detain water for wildlife and livestock. Over time, the dam developed a headcut around the drop pipe, which eroded through the reservoir and formed an incised channel. Since the impoundment was no longer essential to local management, the BLM Miles City Field Office decommissioned the dam in 2013. The field office then performed restoration of riparian areas, which included reconnecting stream segments above and below the reservoir and installing temporary grade control structures until the establishment of sufficient native vegetation for channel stabilization.

In the spring of 2014, less than a year after restoration was completed, a 50-year flood event occurred. All grade control structures withstood the event, with the exception of a straw bale step structure that was subsequently repaired. Monitoring in 2015 indicated stable channel banks and continued growth of riparian vegetation throughout the project area. This project restored Lone Tree Creek to a stable, intermittent prairie stream and reduced the delivery of sediment to receiving surface waters. The project also improved water quality and reduced evaporative water losses.



The Blackfoot Dam's failed drop pipe in May 2012 and the eroding channel in the drained reservoir.

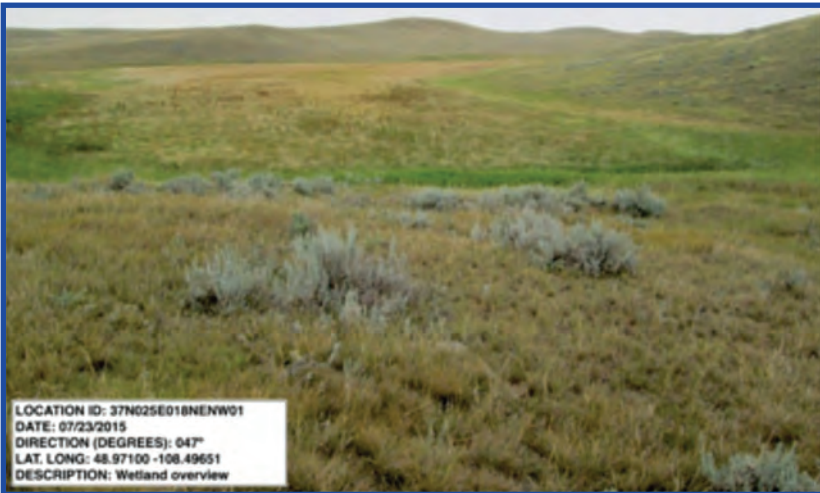


A portion of a 10-acre enclosure that was constructed around Dyce Creek riparian habitat and a portion of a 0.4-mile road closure.

Dillon Field Office Assesses Watersheds and Restores Trout Habitat – Colorado

In 2015, the BLM Dillon Field Office assessed priority watersheds and conducted watershed plan implementation. Monitoring data were used to identify areas that need improvement, adjust management where appropriate, and implement structural projects where management changes alone were insufficient to achieve desired landscape conditions. Overall, these efforts led to the completion of two watershed assessments and corresponding decisions covering about 130,000 acres, 17 structural projects, and 2 miles of vegetation treatments that improved watershed function.

The field office performed several efforts to improve water resources in Dyce Creek—a pure westslope cutthroat trout stream that is listed as “impaired” in accordance with Section 303(d) of the Clean Water Act. Specifically, an interdisciplinary team addressed effects associated with roads, culverts, conifer encroachment, and livestock grazing management. The team used data from a watershed assessment to identify active and passive management actions to improve water quality/quantity, soil health, and habitat resources throughout the watershed.



Prairie pothole wetland in the BLM HiLine District in proper functioning condition.

Inventory Helps to Construct a Database of Lentic Resources and Conditions – Montana/Dakotas

In 2015, the BLM HiLine District inventoried prairie potholes and artificial impoundments to construct a database of lentic water resources and their corresponding conditions so that the BLM can better respond to changing needs and climatic influences. The district’s Wetland and Riparian Interdisciplinary Team worked with a contractor to inventory, categorize, and assess the conditions of 80 lentic-wetland areas covering 442 acres of public land. The team estimated hydroperiod from diagnostic plant communities and established permanent photo points to supplement other indicators of trend. This type of water resource information is increasingly important because water storage and hydroperiod in prairie pothole wetlands is highly variable across space and time, making them extremely susceptible to climate change. Knowing the location, condition, and expected hydroperiod will improve the BLM’s ability to ensure a balance between water availability and resource demands associated with wildlife and authorized activities.



This reservoir, constructed in 1939, supports 5.1 acres of wetland in proper functioning condition.

MOU Tackles Nonpoint Source Pollution to Improve Water Quality – Montana/Dakotas

In 2008, the State of Montana's "Final Water Quality Integrated Report" concluded that nonpoint source pollution is the leading cause of surface water impairment in Montana. Subsequently, the BLM Montana/Dakotas State Office and the Montana Department of Environmental Quality entered into a memorandum of understanding (MOU) that outlines a process for cooperatively controlling and abating water pollution from BLM-administered lands. In 2015, the MOU participants reached the 5th anniversary of this increasingly successful effort.

Due to the dispersed nature of nonpoint source pollution, complicated land ownership patterns in Montana, and separate but parallel agency missions, nonpoint source pollution management requires close coordination between stakeholders and regulators. In this regard, the MOU has substantially improved communication, coordination, and statewide efforts to improve water quality. This collaboration has improved water quality management by increasing the economies of scale and interagency coordination, as well as capitalizing on agency-specific expertise. As a result, actions to improve water quality are more targeted, involve more stakeholders, and provide insight to the success/failure of mitigation in ways that would not be feasible through unilateral efforts.

Water quality data help the BLM identify areas requiring additional monitoring and/or management action changes. In 2015, the Montana Department of Environmental Quality collected 7,180 water quality samples along 83 stream sites associated with projects related to BLM-managed lands. These data, along with designated beneficial uses information and corresponding support analyses, provided the BLM with information vital to land health assessments, ongoing projects, and the development of corresponding management actions.

During 2014 and 2015, the BLM completed several site-specific evaluations of impaired streams and initiated mitigation where necessary. These assessments emphasized improving water quality by reducing streamside/riparian effects and sediment production, including: modification of livestock grazing and erosion control at 14 sites near the Blackfoot River; completion of 23 land health assessments near the lower Big Hole River, which showed that 81 percent of BLM-administered lands meet land health standards or are improving, and are unlikely to be the source of impairment; completion of land health assessments in the Centennial Watershed, which showed 86 percent of the streams are at proper functioning condition and 11 percent are functioning at-risk with an improving trend; and 10 miles of lotic assessments in the Boulder and Jefferson Watersheds, which showed riparian conditions are improving substantially since management actions were adjusted.



Jones Creek in 1999 when it was not functioning.



Jones Creek in 2015 when it was in proper functioning condition.

Project Points Way to Better Air Resource Modeling – Montana/Dakotas

The Montana/Dakotas State Office initiated the most comprehensive air resource modeling project ever performed for Montana, North Dakota, and South Dakota and completed the meteorological modeling portion of the project in early 2015. Air resource modeling is used to predict impacts from future activities, and meteorological modeling is the linchpin of this process. Meteorological modeling results are evaluated using performance metrics comparing modeled weather to observed weather during a baseline year. Wind speed, wind direction, mixing height, and precipitation are all analyzed. The BLM Montana/Dakotas Weather Research and Forecasting model exhibits better performance than any previous model of the same type for the three-state area. Modelers from the National Park Service and Environmental Protection Agency plan to use the results of the BLM's Weather Research and Forecasting model to improve their modeling efforts.

BLM and Partners Host Forum about the San Juan Basin Methane Hotspot – Four Corners Region

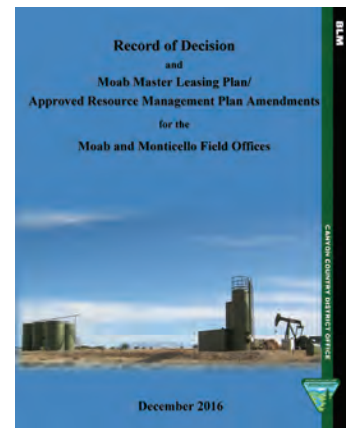
According to data from the Environmental Protection Agency, the San Juan Basin near the Four Corners region in the Southwestern United States has some of the highest levels of methane in the country. One of the main sources of methane in this area is emissions from processing equipment at oil and gas production sites. The BLM joined with the National Oceanic and Atmospheric Administration (NOAA) to survey the basin in early 2015 using aircraft equipped with air monitoring devices. This methane “hotspot” has stimulated a great deal of interest in additional research in the basin. The BLM partnered with the New Mexico Environment Department, Colorado Department of Public Health and Environment, and Southern Ute and Navajo Nation tribal environmental agencies to provide information to residents at a public forum. The public forum hosted more than 200 attendees in April 2015, and researchers from the National Aeronautics and Space Administration (NASA), NOAA, Los Alamos National Laboratory, and Western Regional Air Partnership presented their ongoing research and projects from the Four Corners region. A round of scientific papers detailing new findings is expected in the upcoming future.

NOC Provides Technical and Air Quality Modeling Support for Numerous NEPA Projects – National Operations Center

Staff at the BLM National Operations Center (NOC) provided air quality and climate change support on approximately 35 resource management plans (RMPs) and environmental impact statements (EISs) in support of BLM priorities. This support included providing technical input to enhance the air quality sections of RMPs and EISs, including discussions on ambient air quality and climatic conditions. For example, the NOC contributed the greenhouse gas and climate change components of the Eastern Interior RMP for Alaska, Four Rivers RMP for Idaho, and Upper Snake RMP for Idaho.

NOC staff also completed 17 air quality modeling reviews for 6 states implementing BLM priorities, such as oil and gas leasing/permitting and locatable mineral extraction (e.g., copper, silver, gold, and barite). This included thorough technical reviews of emission inventories/factors, physical configurations for proposed or modified sources, review of modeling protocols, and thorough review of technical support documents that present detailed results of dispersion modeling exercises.

One of the NOC's most extensive modeling analysis and review highlights of the year involves BLM Utah's Draft Moab Master Leasing Plan, which considers oil and gas leasing on approximately 783,000 acres of public lands within the Canyon Country District. The NOC's analysis addressed the level of oil and gas activity that can be reasonably expected to occur during the next 15 years based on the 2005 reasonably foreseeable development and took into account updated information about current and historical oil and gas activities specific to the area, including leasing, geophysical exploration, drilling, and production. The NOC and U.S. Fish and Wildlife Service air modeling teams created models for high, medium, and low emissions scenarios, under the guidance of BLM Utah. Model results showed potential adverse effects related to road dust emissions and visibility. Based on the results of the modeling analysis, BLM Utah derived and implemented specific mitigation and subsequent field studies.



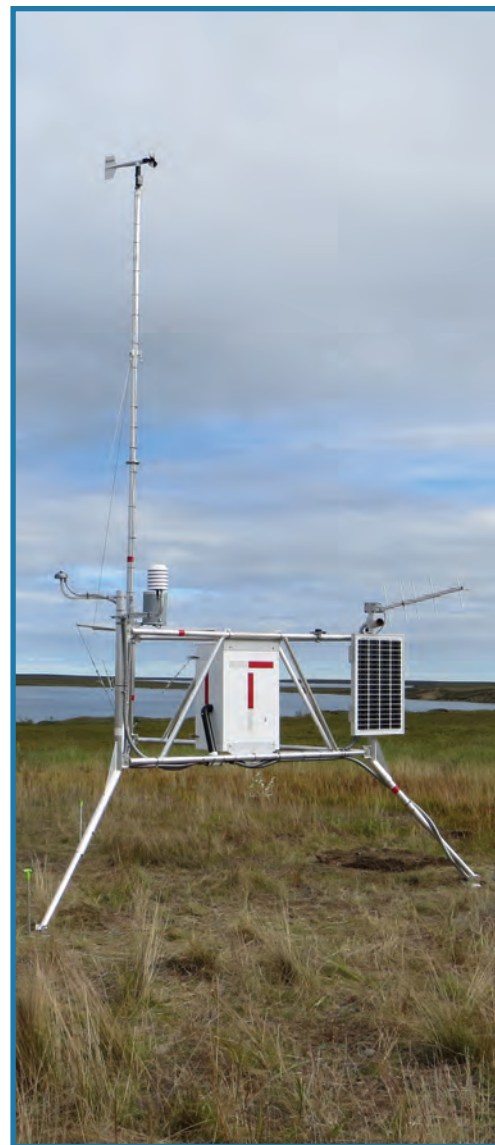
BLM Continues Climate Monitoring Program at the National Petroleum Reserve – Alaska

The BLM climate monitoring program incorporates data from the BLM and other agencies to provide spatial coverage for all three physiographic regions within the National Petroleum Reserve in Alaska (NPR-A). Climate data sources include remote automated weather stations (RAWS) at the Umiat and Inigok airstrips, a U.S. Climate Reference Network station at Ivotuk airstrip, eight river gauges, and the Department of the Interior/Global Terrestrial Network for Permafrost (DOI/GTN-P) climate monitoring program.

At the Umiat airstrip, the BLM maintains a hybrid energy system charged by solar, wind, and diesel to ensure operation of the internet and webcam equipment. The U.S. Geological Survey maintains a smaller but similar system at Inigok. These systems allow year-round communication with the DOI/GTN-P radio-networked climate monitoring sites and provide BLM personnel access to critical aviation-related websites while working in Umiat. The webcam equipment is critical for flight planning and safety, allowing pilots to verify that field conditions are acceptable before attempting to land. In addition, snow surveys are performed in the NPR-A to validate automated snow depth sensor readings, help the BLM focus monitoring efforts where needed for low-snow conditions, predict lake recharge, and obtain winter snow water equivalent values.

Umiat is an important staging area for oil and gas exploration and research activities in the NPR-A. Umiat weather records began in 1949, but that program was discontinued in 2001. In 2002, the BLM installed a weather station at Umiat to continue the long-term weather record, converting to a RAWS station in 2013. The BLM also maintains weather stations at Fish Creek, Ikpikpuk River, and Otuk Creek gauging sites to provide real-time weather data representing coastal plain, foothills, and Brooks Range regions. Air temperature and precipitation records were added to other gauge sites to enhance the interpretation of streamflow records and for use in regional climate analyses.

As a part of the BLM's adaptive management strategy, the BLM is required to monitor and evaluate permitted activities, such as oil and gas exploration. To do this, the BLM collects and correlates hydrological and meteorological data with critical aquatic and terrestrial habitat areas for fisheries, waterfowl, and mammals. The data are also used for climate change modeling. Additionally, the BLM uses real-time and historical climate records to determine opening and closing dates for tundra and ice road travel and to evaluate the likelihood of recharge to water bodies.



A remote automated weather station at the Umiat airstrip in the National Petroleum Reserve in Alaska.



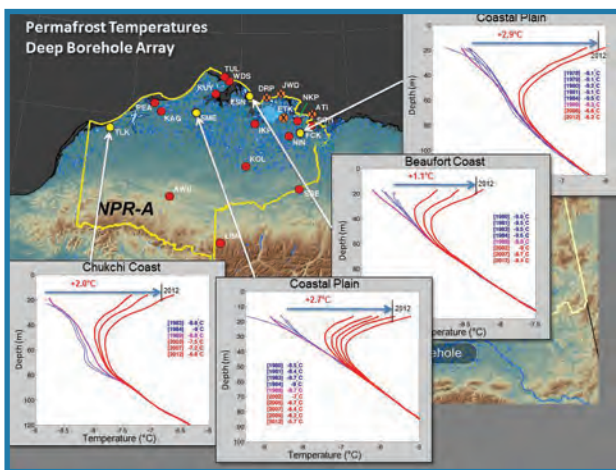
The hybrid power system at the Umiat airstrip, which powers the internet and webcam equipment. This power is critical for year-round communication with monitoring equipment.



BLM Colorado's portable air quality monitoring unit.

Portable Equipment Monitors Air Quality at Three Locations – Colorado

The Colorado State Office is currently monitoring air quality at three locations in Colorado—Rangely, Meeker, and Fairplay. The air station was designed to be mobile, allowing it to be moved to a new location after collecting sufficient baseline data. The air quality contract also provides for portable dust monitoring equipment to be deployed by field office staff to aid in refining the BLM's understanding of dust-related effects from oil and gas development in the Kremmling Field Office. The dust monitoring equipment accompanies meteorological instrumentation that will help the BLM understand downwind concentrations of various development processes next to well pads and access roads. Working with the Agricultural Research Service, digital cameras were added to the Rangely and Meeker stations to monitor visibility; a new air quality (visibility and meteorological) monitoring site was established on Magnolia Ridge in the Piceance Basin; and a real-time webpage was created for the Rangely, Meeker, and Piceance Basin monitoring sites.

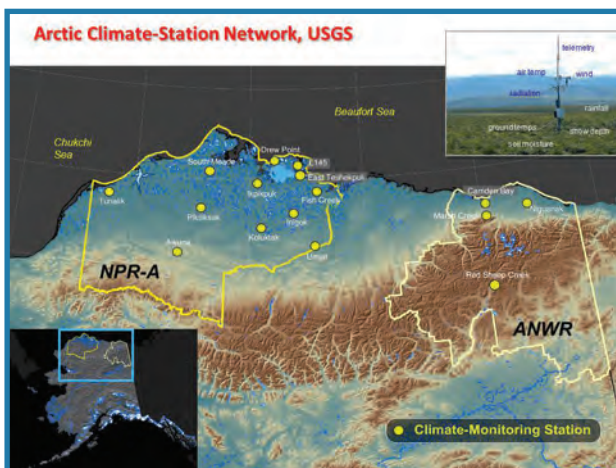


This array of boreholes monitors changes in the thermal state of permafrost in the National Petroleum Reserve in Alaska.

BLM Supports Global Terrestrial Network for Permafrost in NPR-A – Alaska

The BLM continues to provide logistical and financial support for the Department of the Interior/Global Terrestrial Network for Permafrost (DOI/GTN-P) observing network. The DOI/GTN-P observing network consists of two primary arrays located in the National Petroleum Reserve in Alaska (NPR-A). An array of 14 deep boreholes monitors changes in the thermal state of permafrost. An array of 11 climate monitoring stations satisfies a variety of DOI mission needs in the NPR-A.

Both arrays formally contribute to a number of global observing systems, including the Global Terrestrial Network for Permafrost, Global Terrestrial Observing System, and Global Climate Observing System. This network will improve the BLM's and DOI's understanding of the interaction between surface conditions and the active layer that is fundamental in providing essential baseline physical data for biological research and monitoring projects.



This array of climate monitoring stations satisfies a variety of Department of the Interior mission needs in the National Petroleum Reserve in Alaska.

The climate monitoring stations provide inputs needed for permafrost characterization and effects assessment models. The meteorological sensors are used for climate projects, weather prediction, storm surge and coastal erosion modeling efforts, and short- and long-term interdisciplinary monitoring and research projects, such as understanding caribou movement patterns, coastal erosion, timing of break-up and freeze-up, and bird and fish habitat changes.

Monitoring physical properties of permafrost and thereby understanding basic landscape conditions and trends will assist in determining potential negative effects of oil and gas drilling and production, potentially resulting in additional and/or more defined stipulations/best management practices. Real-time environmental data from this network are used in tundra travel decisions and monitoring, logistics, and air operations. Networked sensors monitor air temperature, soil temperature, relative humidity, precipitation, wind speed and direction, barometric pressure, snow depth, and solar radiation.

BLM Supports National Wind Erosion Research Network – Colorado

The BLM San Luis Valley Field Office collaborated with the Jornada Experimental Range to install 1 of 12 new wind erosion monitoring stations in south-central Colorado. This station will be part of the National Wind Erosion Research Network, which will be the first national, long-term, intensively instrumented wind erosion research network in the world. Interest in the network is anticipated to attract local and international collaborators who work on wind erosion issues. Data collected using standard methods across a range of land use and management systems will provide excellent opportunities to further the BLM's understanding of wind erosion processes and develop models that will benefit land managers.

The monitoring station site occupies 1 hectare with a 33-foot-tall meteorological tower at the center. The tower is equipped with instruments to measure wind speed and temperature profiles, relative humidity, rainfall, and the transport of soil by wind. Sediment samplers, which trap airborne soil particles, are located randomly within a grid surrounding the tower, and samples will be collected on a monthly basis. The BLM has collected baseline measurements of soil properties and vegetation, including cover, height, and spacing, and these same data will be collected on a seasonal basis. The BLM will conduct data collection activities as required by the National Wind Erosion Research Network and BLM assessment, inventory, and monitoring protocols. The BLM will also troubleshoot and assist with maintenance of automated data collection devices as needed.



The 33-foot-tall meteorological tower at the wind erosion monitoring site in the San Luis Valley.

Partnership Entails Sampling Precipitation Chemistry and Quantity – Colorado

The Little Snake Field Office partnered with the National Atmospheric Deposition Program (NADP) to sample the chemistry and quantity of precipitation inputs at the Sand Springs site in northwest Colorado on a weekly basis. The trends in the chemical composition and quantity of inputs of atmospheric water may have significant effects on land managed by BLM. This NADP site is one of the longest standing sites in the network, with a period of record beginning in 1979. Such a long-term record is extremely valuable for scientists, decisionmakers, and land managers to assess trends in the physical and chemical inputs that affect public lands.



Equipment at the Sand Springs National Atmospheric Deposition Program site in the BLM Little Snake Field Office that is used to help sample precipitation chemistry and quantity in northwest Colorado.



The University of Wyoming's mobile air quality laboratory at the Blizzard Heights site in Converse County, Wyoming.

BLM Completes 3-Year Air Quality Study with the University of Wyoming – Wyoming

The BLM, in cooperation with the University of Wyoming's Department of Atmospheric Science, wrapped up a 3-year study using a mobile air quality laboratory in Converse County, Wyoming. The laboratory was installed to establish baseline air quality conditions in anticipation of federal minerals development. Those who took part in the cooperation expended considerable time and effort to locate a site that is representative of regional background air quality.

